Assignment- Rules of differentiation

Differentiate each function with respect to *x*.

1) $y = \left(x^2 + 4\right)\cos 2x^5$

2) $y = \dfrac{\sin 3x^3}{5x^4 + 4}$

3) $y = \tan \dfrac{4x^5}{-3x^4 + 2}$

4) $y = \dfrac{\cos 3x^3}{2x^4 + 3}$

5) $y = \cos x^5 \cdot \left(4x^4 + 3\right)$

6) $y = \left(5x^5 + 2\right)\cos 2x^2$

7) $y = e^{4x^4}\left(2x^3 + 3\right)$

8) $y = \dfrac{3x^3 + 4}{\ln 5x^4}$

9) $y = \left(2x^4 - 3\right) \cdot e^{4x^3}$

10) $y = \ln 4x^2 \cdot \left(2x^3 + 1\right)$

11) $y = \dfrac{2x^4 - 3}{e^{3x^5}}$

12) $y = \dfrac{\ln 3x^5}{x^3 + 5}$

13) $y = \dfrac{5x^5 - 2}{2^{5x^2}}$

14) $y = \dfrac{3^{5x^2}}{2x^3 + 3}$

15) $y = \left(5x^3 - 3\right)\log_4 x^2$

16) $y = 2^{4x^5}\left(x^4 + 1\right)$

17) $y = \log_3 2x^5 \cdot \left(3x^4 + 1\right)$

18) $y = \left(3x^2 + 5\right) \cdot 4^{5x^3}$

Use logarithmic differentiation to differentiate each function with respect to x.

19) $y = 3x^{5x}$

20) $y = 2x^{2x}$

Answers to Assignment- Rules of differentiation (ID: 1)

1) $\dfrac{dy}{dx} = (x^2 + 4) \cdot -\sin 2x^5 \cdot 10x^4 + \cos 2x^5 \cdot 2x$

$= 2x(-5x^5\sin 2x^5 - 20x^3\sin 2x^5 + \cos 2x^5)$

2) $\dfrac{dy}{dx} = \dfrac{(5x^4 + 4) \cdot \cos 3x^3 \cdot 9x^2 - \sin 3x^3 \cdot 20x^3}{(5x^4 + 4)^2}$

$= \dfrac{x^2(45x^4\cos 3x^3 + 36\cos 3x^3 - 20x\sin 3x^3)}{(5x^4 + 4)^2}$

3) $\dfrac{dy}{dx} = \sec^2 \dfrac{4x^5}{-3x^4 + 2} \cdot \dfrac{(-3x^4 + 2) \cdot 20x^4 - 4x^5 \cdot -12x^3}{(-3x^4 + 2)^2}$

$= \dfrac{4x^4\sec^2 \dfrac{4x^5}{-3x^4 + 2}(-3x^4 + 10)}{(-3x^4 + 2)^2}$

4) $\dfrac{dy}{dx} = \dfrac{(2x^4 + 3) \cdot -\sin 3x^3 \cdot 9x^2 - \cos 3x^3 \cdot 8x^3}{(2x^4 + 3)^2}$

$= \dfrac{x^2(-18x^4\sin 3x^3 - 27\sin 3x^3 - 8x\cos 3x^3)}{(2x^4 + 3)^2}$

5) $\dfrac{dy}{dx} = \cos x^5 \cdot 16x^3 + (4x^4 + 3) \cdot -\sin x^5 \cdot 5x^4$

$= x^3(16\cos x^5 - 20x^5\sin x^5 - 15x\sin x^5)$

6) $\dfrac{dy}{dx} = (5x^5 + 2) \cdot -\sin 2x^2 \cdot 4x + \cos 2x^2 \cdot 25x^4$

$= x(-20x^5\sin 2x^2 - 8\sin 2x^2 + 25x^3\cos 2x^2)$

7) $\dfrac{dy}{dx} = e^{4x^4} \cdot 6x^2 + (2x^3 + 3) \cdot e^{4x^4} \cdot 16x^3$

$= 2x^2e^{4x^4}(3 + 16x^4 + 24x)$

8) $\dfrac{dy}{dx} = \dfrac{\ln 5x^4 \cdot 9x^2 - (3x^3 + 4) \cdot \dfrac{1}{5x^4} \cdot 20x^3}{(\ln 5x^4)^2}$

$= \dfrac{9x^3 \ln 5x^4 - 12x^3 - 16}{x \cdot (\ln 5x^4)^2}$

9) $\dfrac{dy}{dx} = (2x^4 - 3) \cdot e^{4x^3} \cdot 12x^2 + e^{4x^3} \cdot 8x^3$

$= 4x^2e^{4x^3}(6x^4 - 9 + 2x)$

10) $\dfrac{dy}{dx} = \ln 4x^2 \cdot 6x^2 + (2x^3 + 1) \cdot \dfrac{1}{4x^2} \cdot 8x$

$= \dfrac{2(3x^3 \ln 4x^2 + 2x^3 + 1)}{x}$

11) $\dfrac{dy}{dx} = \dfrac{e^{3x^5} \cdot 8x^3 - (2x^4 - 3) \cdot e^{3x^5} \cdot 15x^4}{(e^{3x^5})^2}$

$= \dfrac{x^3(8 - 30x^5 + 45x)}{e^{3x^5}}$

12) $\dfrac{dy}{dx} = \dfrac{(x^3 + 5) \cdot \dfrac{1}{3x^5} \cdot 15x^4 - \ln 3x^5 \cdot 3x^2}{(x^3 + 5)^2}$

$= \dfrac{-3x^3 \ln 3x^5 + 5x^3 + 25}{x(x^3 + 5)^2}$

13) $\dfrac{dy}{dx} = \dfrac{2^{5x^2} \cdot 25x^4 - (5x^5 - 2) \cdot 2^{5x^2} \ln 2 \cdot 10x}{(2^{5x^2})^2}$

$= \dfrac{5x(5x^3 - 10x^5 \ln 2 + 4 \ln 2)}{2^{5x^2}}$

14) $\dfrac{dy}{dx} = \dfrac{(2x^3 + 3) \cdot 3^{5x^2} \ln 3 \cdot 10x - 3^{5x^2} \cdot 6x^2}{(2x^3 + 3)^2}$

$= \dfrac{2x \cdot 3^{5x^2}(10x^3 \ln 3 + 15 \ln 3 - x \cdot 3)}{(2x^3 + 3)^2}$

15) $\dfrac{dy}{dx} = (5x^3 - 3) \cdot \dfrac{1}{x^2 \ln 4} \cdot 2x + \log_4 x^2 \cdot 15x^2$

$\qquad = \dfrac{15x^3 \log_4 x^2 \cdot \ln 4 + 10x^3 - 6}{x \ln 4}$

16) $\dfrac{dy}{dx} = 2^{4x^5} \cdot 4x^3 + (x^4 + 1) \cdot 2^{4x^5} \ln 2 \cdot 20x^4$

$\qquad = x^3 \cdot 2^{4x^5 + 2}(1 + 5x^5 \ln 2 + 5x \ln 2)$

17) $\dfrac{dy}{dx} = \log_3 2x^5 \cdot 12x^3 + (3x^4 + 1) \cdot \dfrac{1}{2x^5 \ln 3} \cdot 10x^4$

$\qquad = \dfrac{12x^4 \log_3 2x^5 \cdot \ln 3 + 15x^4 + 5}{x \ln 3}$

18) $\dfrac{dy}{dx} = (3x^2 + 5) \cdot 4^{5x^3} \ln 4 \cdot 15x^2 + 4^{5x^3} \cdot 6x$

$\qquad = 3x \cdot 4^{5x^3}(15x^3 \ln 4 + 25x \ln 4 + 2)$

19) $\dfrac{dy}{dx} = y(5 \ln x + 5)$

20) $\dfrac{dy}{dx} = y(2 \ln x + 2)$